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E85 Central Body Electronics

Model: E85

Production: All

OBJECTIVES

After completion of this module you will be able to:

- Understand the operation of central body electronics on the E85
- Locate and identify components of the central body electronics on E85
- Diagnose concerns on the E85 regarding central body electronics.

Central Body Electronics

Introduction

The central body electronics of the E85 are carried over from the E46. The E85 continues to use the familiar ZKE V system with some minor modifications. These modifications are as follows:

General Module V (GM V)

New features of the GM V include:

- A more powerful processor
- 2 outputs for switching off electrical equipment (VA1 and VA2)
- Pulse-width modulated output for the interior lighting

Central Locking System

- The glove compartment is not integrated in the central locking system
- The storage compartment is integrated in the central locking system
- The Low lock is fitted on the driver's side
- The contact for the hotel setting (trunk lock barrel) is not fitted

Seat Adjustment/Memory Functions

- The memory functions are only available for the driver's seat

Soft-top Module (CVM) 4

- The enable signal for relay 2 for activating the rear window heater is generated by the Soft-top module 4.
- The soft-top position is only detected at the limits of movement in either direction.

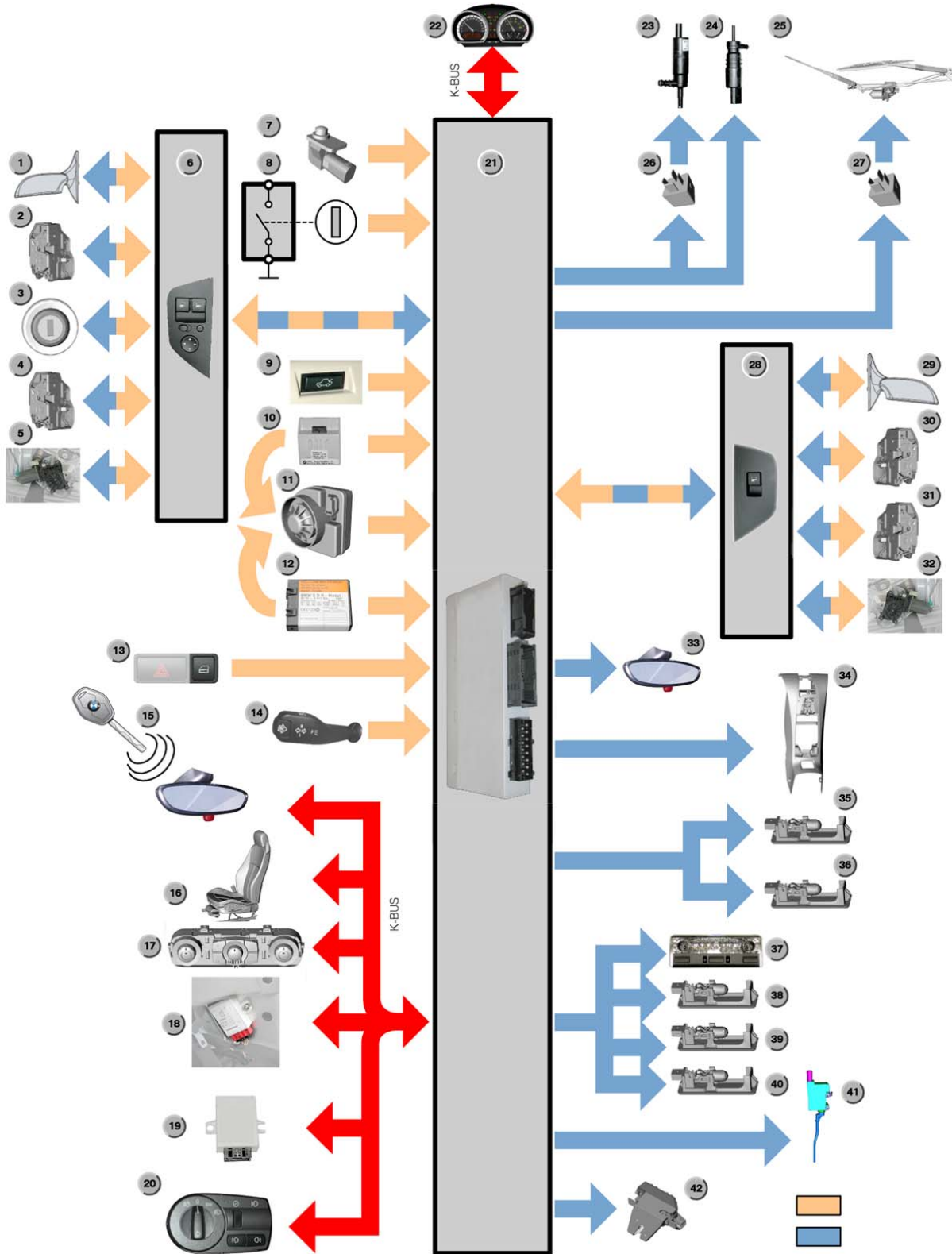
Anti-theft Alarm System

- Operation of the trunk emergency release sets off the alarm if the anti-theft alarm system is armed.

Temperature Switch (Ambient Switch for Heated Washer Functions)

- The temperature switch is located at the front on the left under the cover on the vehicle underbody.

Central Body Electronics Overview



Legend for System Overview

Index	Explanation	Index	Explanation
1	Driver's door mirror	22	Instrument Cluster
2	Driver's central lock servo	23	Windshield washer pump
3	Lock assembly driver's side	24	Headlight washer pump
4	Driver's door switch	25	Wash-Wipe System
5	Driver's window regulator	26	Washer relay
6	Driver's window switch assembly	27	Twin wiper relay module
7	Hood contact	28	Passenger window switch
8	Alarm switch	29	Passenger door mirror
9	Trunk release button	30	Passenger central lock servo
10	Tilt sensor	31	Passenger door switch
11	Siren	32	Passenger window regulator
12	SDR (not for USA)	33	Alarm LED
13	Central lock button	34	Storage compartment servo
14	Steering column switch	35	Footwell light
15	Remote Control	36	Footwell light
16	Seat Module	37	Interior light assembly
17	Air Conditioning	38	Storage compartment light
18	Soft Top Module CVM4	39	Storage compartment light
19	EWS	40	Trunk light
20	LSZ	41	Fuel filler cap servo
21	GM V	42	Trunk lock servo

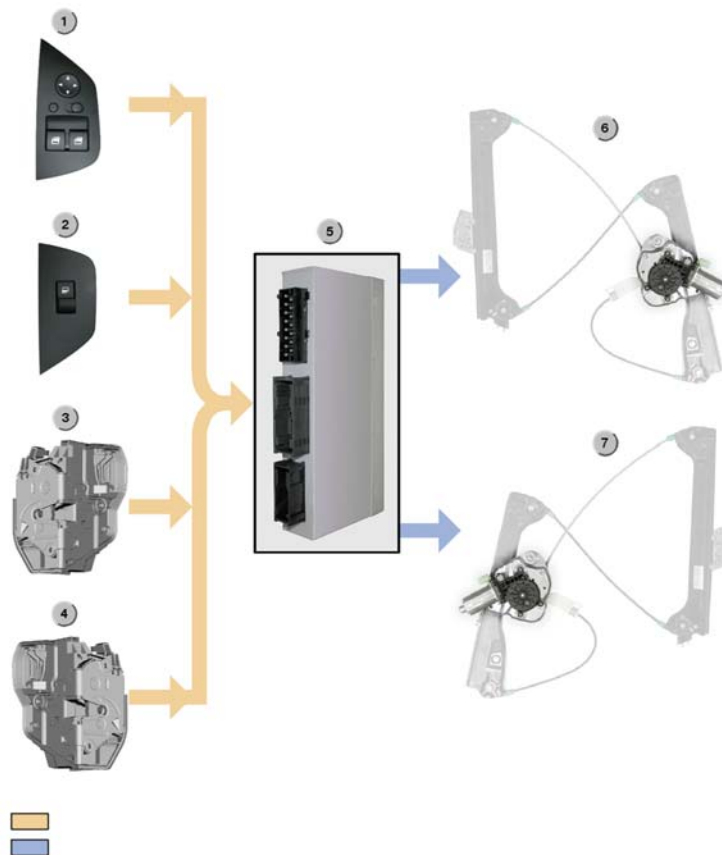
Power Windows

The function of the power windows is based on the function of those fitted on the E46 convertible.

Components

The system consists of the following components:

- Door locks with Hall-effect sensors
- General module 5
- Power window switches
- Window regulator motors



Index	Explanation	Index	Explanation
1	Driver's side window switch	5	General Module (GM5)
2	Passenger side window switch	6	Passenger side window regulator
3	Driver's side lock servo	7	Driver's side window regulator
4	Passenger side lock servo		

Door Locks with Hall-Effect Sensors

The door locks each contain a Hall-effect sensor for detecting the door position. In addition, there are two Hall-effect sensors in the driver's door which monitor the position of the lock barrel.

The Hall-effect sensors signal to the general module that one of the doors is being opened, for example. The general module briefly lowers the window in the door concerned. The window has to be lowered in order that the door can be opened.

General Module 5

The General Module is attached to the lower trim behind the glove compartment. The general module controls the power window functions. It receives the input signals from the door locks and the switch units, and monitors the power consumption of the electric motors that drive the window regulator mechanisms.

The E85 has no anti-trap function available. Consequently, one-touch closing on the passenger side is not allowed. One-touch closing on the driver's side is possible at key positions starting from terminal 15.

One-touch opening is possible at key positions starting from terminal 15 on the driver's and passenger sides.



Power-Window Switches

The power-window switches are integrated in the arm rests of the door trim panels. The driver's-side power-window switch unit also incorporates a switch for the passenger-side window, the buttons for the door mirrors and the mirror folding button.

Each power-window switch has four positions. Those positions trigger different functions depending on country-specific variations and the programming of the general module. The passenger-side power-window switch also has four positions.

Both window switches provide a ground input to the general module.



Window Regulator

The window regulator mechanisms are cable operated. The drive motor is not monitored by Hall-effect sensors.

Central Locking System

Purpose of the System

The central locking system function is based to a large extent on the function of the system on the E46.

New System Features

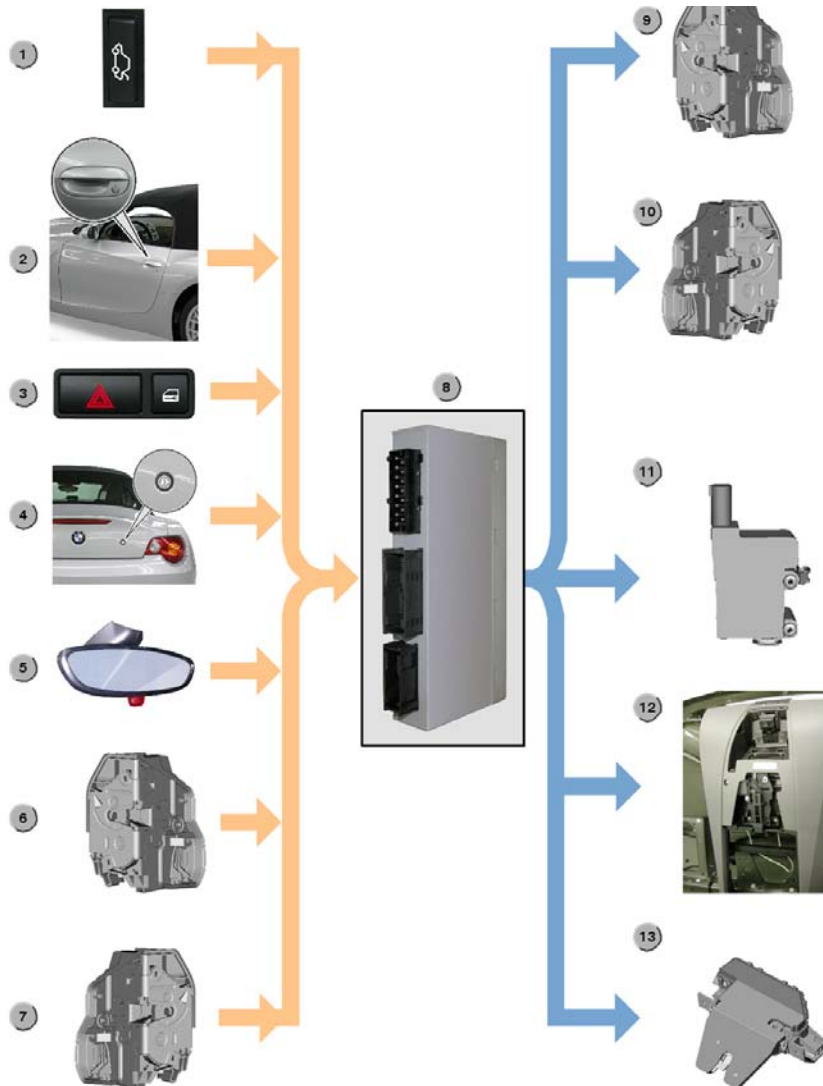
- The storage compartment is integrated in the central locking system function.
- The glove compartment is not operated by the central locking system.
- The trunk lock does not have a hotel setting switch that operates in conjunction with the lock barrel. It is locked by means of a cable mechanism.
- The driver's door lock is the Low lock from the E65.
- The Easy Open/Close function cannot be activated with the remote control.

Components

The system consists of the following components:

- General module 5
- Driver's door lock
- Central locking servo unit, driver's side
- Central locking servo unit, passenger side
- Central locking servo unit, storage compartment
- Central locking servo unit, fuel filler
- Central locking servo unit, trunk
- Trunk lock switch for "deactivating" the anti-theft alarm system
- Trunk release button in passenger compartment
- Central lock button
- Remote control receiver in rear-view mirror base

Central Locking Overview



Index	Explanation	Index	Explanation
1	Trunk release button	8	General Module (GM V)
2	Driver's door lock	9	Driver's door lock motor
3	Central lock button	10	Passenger door lock motor
4	DWA deactivation	11	Fuel filler flap actuator
5	Remote control receiver	12	Storage compartment actuator
6	Driver's door lock switch	13	Trunk actuator
7	Passenger door lock switch		

General Module

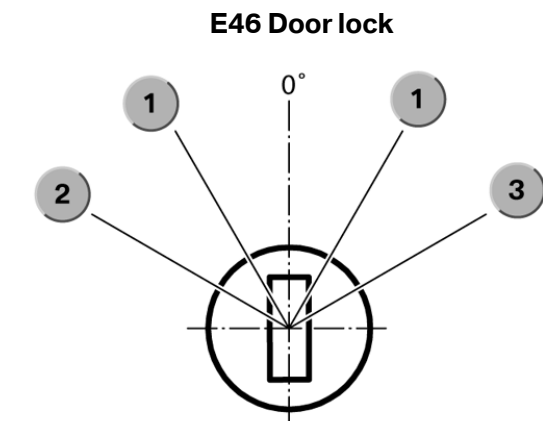
The General Module controls the central locking functions on the E85.

Driver's-Door Lock

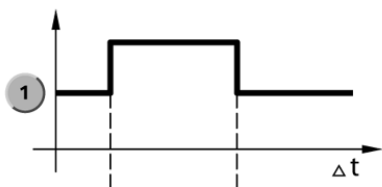
The driver's door lock on the E85 is a Low lock. The same lock was previously fitted as a Low lock on the E66. Compared with the lock used on the E46, this unit incorporates two Hall-effect sensors. The general module analyzes the signals from those sensors and locks/thief-proofs or unlocks the vehicle accordingly.

The order of the signals determines how they are interpreted, i.e. as lock/theft-proof or unlock. By the use of two Hall-effect sensors and the intelligent analysis of their signals, errors when locking/theft-proofing or unlocking the vehicle are prevented.

Detection of a rising edge starts a counter which is stopped again as soon as both signals (SNU 1 and SNU 2) are present. Within a valid time window, the request to lock/theft-proof or unlock is set. As long as the key is held in the turned position, the request to lock/theft-proof or unlock remains valid. If either of the two signals (SNU 1 or SNU 2) is lost, the request is reset again.

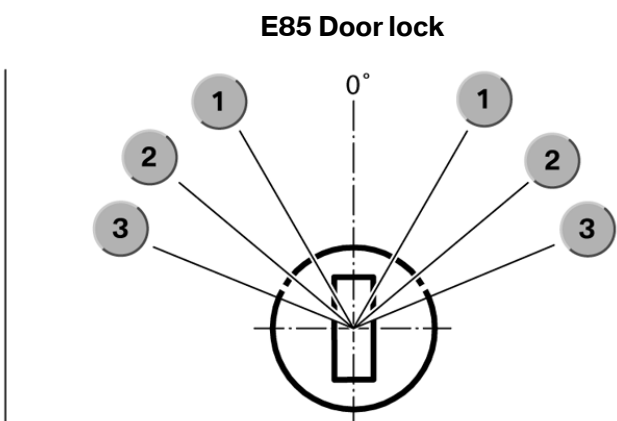


0: Center position 1: Hall effect sensor 1 (SNU1)
2 and 3: Mechanical Lock/Unlock

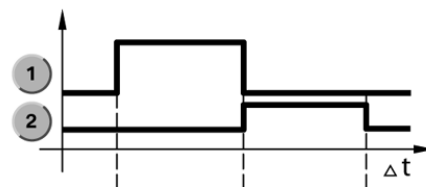


E46 Signal

1: Hall effect sensor 1 (SNU1) 50 milliseconds



0: Center position 1: Hall effect sensor 1 (SNU1)
2: Hall effect sensor 2 (SNU2) 3: Mechanical Lock/Unlock



E85 Signal

1: Hall effect sensor 1 (SNU1)
2: Hall effect sensor 2 (SNU2)
2 to 1000 ms

Central Locking Servo Units

The door lock is a single unit. That unit incorporates the servo motor, the door lock mechanism and the Hall-effect sensors.

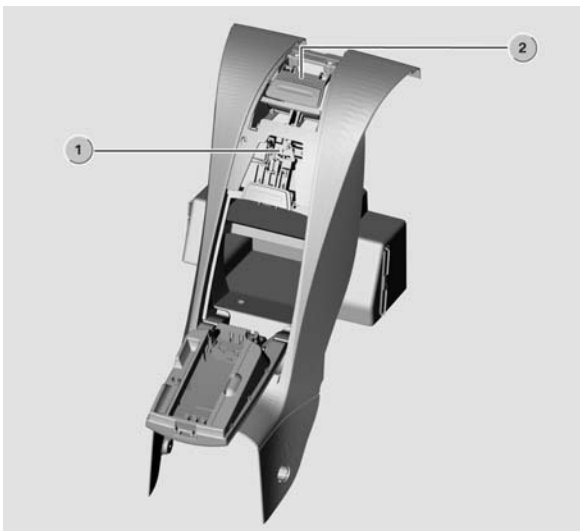


Storage Compartment

The storage compartment is integrated in the central locking system and can be locked/unlocked using the remote control, the driver's-door lock or the Central lock button.

Inside the trunk on the bulkhead there is an emergency release.

The storage compartment is between the passenger seat and the driver's seat in the bulkhead trim.



1. Storage compartment locking servo
2. Storage compartment retainer

Fuel Filler Flap

The fuel filler flap is incorporated in the central locking system. There is an emergency release for the fuel filler flap inside the trunk on the right side under the trunk lining.

Trunk Lock

The trunk lock and lock barrel are identical with those on the E46. The difference between the E85 and the E46 is the linkage between the lock and the lock barrel. Instead of a rod linkage, a cable is used. The lock is released (manually) by a cable mechanism operated by the key. The switch for the anti-theft alarm system is incorporated in the lock barrel.

The trunk lock can be operated manually or electrically. The GM V controls the motor in the trunk lock by means of the "Trunk lock, motor unlock" signal. The locking pawl is moved to the release position by the drive pin. The locking pawl

releases the latch which can then rotate into the disengaged position by the action of the tension spring. The trunk can then be opened. The locking pawl releases the microswitch button from the depressed position. The microswitch switches the trunk light on.

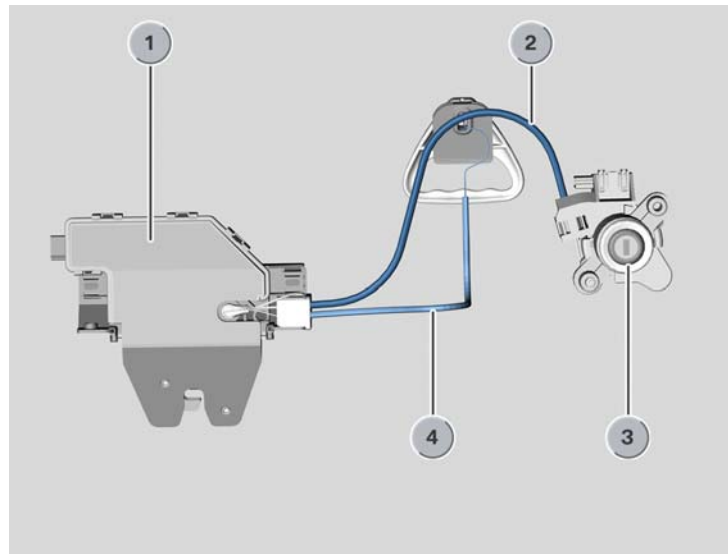
The trunk can be unlocked from the lock barrel. The trunk lock can be unlocked by means of a cable operated by the lock barrel.

The locking pawl is pulled to the release position by the cable. The locking pawl releases the latch which can then rotate into the disengaged position by the action of the tension spring. The trunk can then be opened.

Emergency Trunk Release

The emergency trunk release operates in a similar manner to the mechanical method using the key. The only difference is the actuating device.

A person locked inside the trunk can pull the release handle on the inside of the trunk. The handle is connected to a release cable and attached to the inner trunk lid. Pulling the release handle releases the trunk lock in a similar manner to the preceding description (mechanical method) so that the trunk can be opened.



1. Trunk lock
2. Cable
3. Trunk lock barrel
4. Emergency release handle
5. Cable for emergency trunk release

Power Seat

The seat adjustment and memory functions are carried over from the E46. The memory functions are only available for the driver's seat.

Manual Adjustment of Drives

The adjustment switches in the switch block are used for adjusting the seat manually. The adjustment switch (with integrated control module) is located on the sides of the seats facing the door.

The following adjustments can be made with these switches:

- Seat fore/aft adjustment
- Seat height adjustment
- Seat backrest angle adjustment
- Seat angle adjustment

Programming a Memory Position

On the vehicle, the ignition lock must be in position 1 or 2.

Activate the memory button on the memory switch. Programming readiness is indicated by the memory button lighting up.

Press one of the 3 position buttons to store the current seat position.

The indicator lamp goes out after pressing the position button.

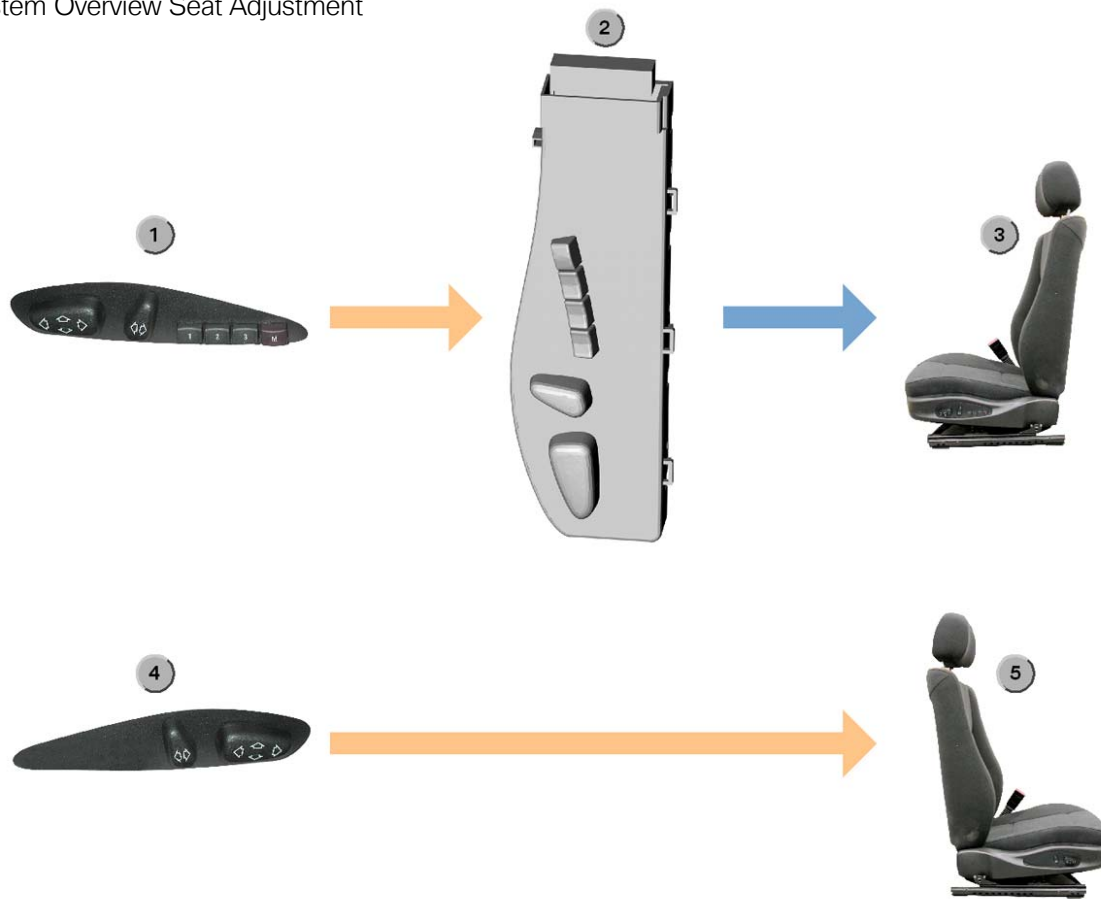
Program readiness is canceled if no position button is pressed within 7 seconds. The position button goes out.

Calling up a Memory Position

A differentiation is made between two operating modes when stored seat positions are retrieved:

- **Touch button operation** - In single-strike mode, it is enough to briefly press one of the 3 position buttons to start the positioning procedure. Positioning runs automatically until the target position is reached. The touch button operation is effective if the driver's door is opened and the ignition-lock is in position 0 or 1. With the driver's door closed, touch button operation is effective in ignition lock position 1.
- **Continuous button operation** - To call up a seat position, the corresponding position button must be pressed continuously to maintain positioning. If the button is released before the target position is reached, the corresponding drive is switched off immediately. The positioning procedure is continued when the position button is pressed again. If another position button is pressed, the positioning procedure for the new position is started. The continuous button operation is effective if the driver's door is opened and the ignition-lock is in position 2. With the driver's door closed, continuous button operation is effective in ignition lock position 0 or 2.

System Overview Seat Adjustment



Index	Explanation	Index	Explanation
1	Driver's seat adjustment controls	4	Passenger seat adjustment controls
2	Driver's seat module	5	Passenger seat adjustment
3	Driver's seat adjustment		

Detection of End Stops

In order to avoid unnecessary engine load and of the ripple count module, there is automatic detection of the adjustment range limits.

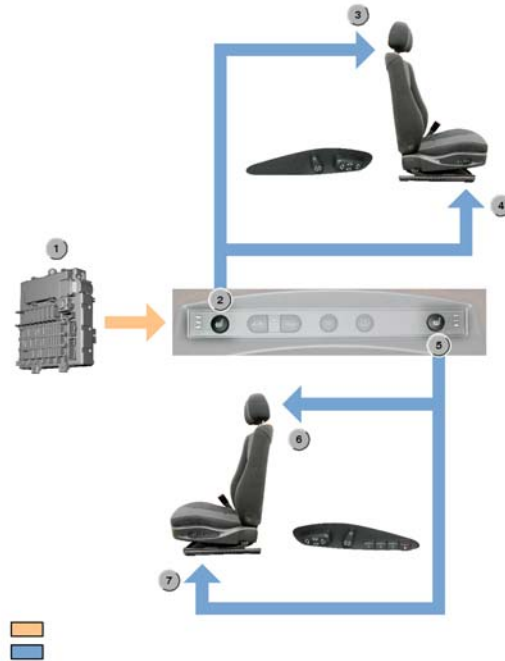
Should a block be detected several times in the same position, the detected position value is interpreted as the end stop. Any further adjustment is terminated before this limit is reached.

An incorrectly detected end stop (e.g. blocking of the seats caused by objects lying around) can be overridden after removal of the blocking, by activating the manual adjustment switch.

Seat Heating

The seat heating functions are based on those on the E46. The seat heater is activated and controlled by means of the seat heater button integrated into the SZM in the center console.

The seat heating system heats the seat cushion area and backrest. The electronics for controlling the selected heating temperature (3 stages) and fault monitoring are integrated in the switching center (SZM).



Index	Explanation	Index	Explanation
1	Fusebox	5	Driver's seat heating switch
2	Passenger seat heating switch	6	Driver's seat backrest heater
3	Passenger seat backrest heater	7	Driver's seat heater
4	Passenger seat heater		

Function

Seat heating can be switched on in three heating stages as from terminal 15 by pressing the button. Three LEDs built into the switching center light to indicate operation.

"Terminal 15 active" is signalled to the switching center via the K-Bus.

Initially, heating stage 1 is activated when the seat heating is switched on (button pressed once). The seat surface is heated up to approximately 44°C. All three LEDs light to indicate operation.

By pressing the button once more, the topmost LED goes out and heating stage 2 is activated. The seat is now only heated up to 39°C.

The seat heating system is switched to heating stage 3 by pressing the button once again. The bottom-most LED lights. The seat is heated up to 35°C.

The seat heating is switched off by pressing the button once again or switching off the ignition. The seat heating can also be switched off in any heating stage by pressing the push button for longer than 1 second.

The seats are heated by means of carbon fiber heating mats in the main section and steel wires (steel filament) in the bolster. A carbon fiber heating mat is installed in both the seat cushion section as well as in the backrest. The center sections of the seat and backrest as well as the bolsters of the seat and backrest are always heated. Heating filament or carbon fibre mats are additionally integrated in the thigh support on sports seats.

The temperature is measured by a temperature sensor in the seat upholstery and passed on to switching center.

Monitoring Functions

Battery Voltage

The electronic seat heating control switches off the power supply to the heating mats if the battery voltage in the vehicle is less than 11.4 V \pm 0.3 V. The function LEDs however remain on. Power supply to the heating mats is restored when the battery voltage is greater than 12.2 V \pm 0.3 V for at least 5 seconds.

PC-Board Temperature

Due to the fact that the power input of the seat heating system is very high (120 W), the temperature of the pc-board in the switching center is monitored by temperature sensors. Initially, the heating power is reduced as the temperature increases to over 85°C. The heating is switched off if the pc-board temperature exceeds 95°C. The function LEDs however remain on. The seat heating cuts in automatically again when the pc-board temperature drops below 85°C.

Fault Monitoring

The electronic seat heating control system monitors the temperature sensor and heating mats for faults. Detected faults are stored in the fault code memory of the switching center.

The following faults can be recognized:

- Short-circuit or line break
- Short-circuit or line break of temperature sensors
- Break in heating mats

If a break or short occurs at the temperature sensor, the seat heating is switched off in order to prevent overheating. The function LEDs are switched off.

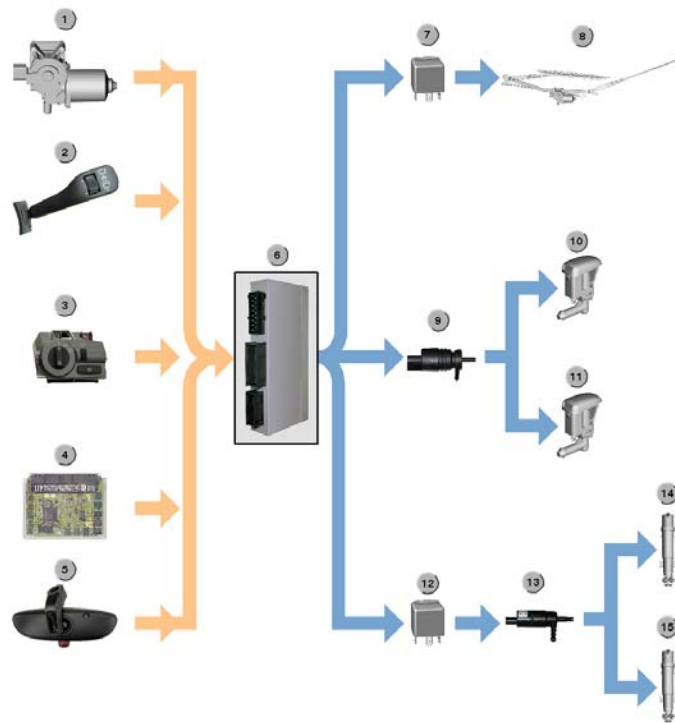
Wiper System

The function of the wash-wipe system is based on that of the E46 wash-wipe system.

Components

The Wiper system consists of the following components:

- Windshield washer system
- Steering-column switch
- Rain/light sensor (RLS)
- Headlight washer system



Index	Explanation	Index	Explanation
1	Wiper motor	9	Windshield washer relay
2	Wiper switch	10	Windshield washer pump
3	Light switch center	11	Left washer jet
4	DSC	12	Right washer jet
5	RLS	13	Headlight washer relay
6	General Module (GM V)	14	Headlight washing pump
7	Wiper twin-relay module	15	Left headlight washer
8	Wipe-wash system	16	Right headlight washer

Windshield Wash

The wipe and wash functions are controlled by the general module (GM V).

Wipe Functions

All wiper functions are active as from ignition lock position 1 (terminal R).

Wiper Stages 1 and 2

Wiper stages "1" and "2" are controlled depending on the depending on the car's road speed.

When stage 2 is switched on, stage 1 cuts in at > 210 km/h to prevent the windshield wiper arm from lifting.

Road Speed	Switch set to Stage 1	Switch set to Stage 2
< 4km/h	Intermittent wipe	Wiper motor at Stage 1
> 4km/h	Wiper motor at Stage 1	Wiper motor at Stage 2

Intermittent Mode

Intermittent wipe is activated in the first setting of the wiper switch. The intermittent wipe time can be set by means of a rotary switch on the wiper switch in four stages. The intermittent wipe time is also influenced by the driving speed.

Wiper Switch

Switch Positions

The wiper switch can be switched to the positions:

- Intermittent wipe = First setting
- Wiper stage 1 = Second setting
- Wiper stage 2 = Third setting

These positions are transferred via two signal lines to the general module.

Signal Line (SW1)	Signal Line (SW2)	Function
0	0	Rest position, wiper OFF
1	0	Intermittent wipe
0	1	Wiper speed 1
1	1	Wiper speed 2

Potentiometer for Wiper Interval

A potentiometer in the form of a rotary switch is built into the wiper switch to vary the setting of the intermittent wipe interval. The rotary switch can be set in four stages. Based on different resistance values. The general module 5 can detect the switch position and thus the preselected intermittent wipe time.

Resistance	Switch Position	Intermittent wipe time (speed dependent)
2 kOhm	Position 1	25 to 13 Seconds
4 kOhm	Position 2	17 to 7 Seconds
6 kOhm	Position 3	10 to 3 Seconds
8 kOhm	Position 4	5 to 2 Seconds

Wiper Motor

Wiper Motor and Wiper Relay

The wiper motor is designed for two speed stages. It is powered via an external twin relay.

The output WI 1 (signal name) at the general module switches on the wiper. The output WI 2 (signal name) switches the wiper motor to stage 2.

Reset Contact

The reset contact in the wiper motor serves the purpose of detecting the wiper rest position. The contact is designed as a slip ring.

Interlock

The signals from the wiper reset contact are used to detect possible blocking of the windshield wiper motor.

The wiper motor is switched off immediately if there is no feedback from the reset contact for 16 seconds with the wiper motor switched on (e.g. to prevent dry running).

The wiper motor is switched on again after a waiting time of 3 minutes or after terminal R off.

However, the wiper motor is not switched on automatically even if the wiper switch remains on (risk of injury) but rather only after the wiper switch has been switched off and then on again.

Jamming protection is active in all wiper stages!

Wash Functions

The wash functions are controlled by the general module 5.

A wash function is triggered by pressing the wipe-wash switch and switching on the windshield wipers in stage 1. The water pump is driven for as long as the wash function is implemented.

After the pump is switched off, the wiper pump is activated for 3 wipe cycles to wipe the windshield dry.

Rain/Light Sensor

A rain/light sensor is available as an option on the E85. The headlights are switched on/off automatically by the rain/light sensor according to the ambient light conditions. The rain/light sensor detects the presence of water on the windshield and switches the windshield wiper on and off accordingly.

The rain/light sensor is fitted in the base of the rear-view mirror and it consists of optical sensors. The RLS has 2 optical sensors integrated in the casing of the automatic interval control module. The 2 new sensors supplement the otherwise unchanged wiper interval control function of the automatic interval control module as follows:

- An ambient-light sensor detects the light intensity above the vehicle within a wide scanning angle.
- A forward light sensor detects the light intensity within a narrow scanning angle directly ahead of the vehicle.

An internal processor calculates from the readings taken by the ambient and forward light sensors whether the preconditions for switching on the lights are present.

The RLS checks the following preconditions for switching on the headlights:

- Twilight
- Complete darkness
- Entry in underground car park
- Entry in tunnel

If any of the above conditions is met, the rain/light sensor on the E85 sends the information via the K-Bus to the light switch center. In order to be able to control the headlights automatically, the rain/light sensor must be activated by a separate light switch setting on the light switch center.

If the light switch on the light switch center has been set to the position for automatic control of the headlights, the exterior/instrument panel lights are switched on by the light switch center. The preconditions for switching on the lights are as follows:

- One of the rain/light sensor conditions listed above is met.
- The fog lamps are switched on.

Note: If the above conditions exist, the lights can only be switched off by switching off the fog lamps. In addition, the lights are switched on if any of the following faults occur:

- The rain/light sensor detects a sensor fault.
- There is a fault in communication between the rain/light sensor and the light switch center.

The following lights are controlled by the light switch center:

- If terminal R is "ON," the side lights, the licenser-plate light and the instrument panel lights are switched on.
- If terminal 15 is "ON," the low-beam headlights are also switched on. If only the side lights are required at that setting, the switch on the light switch center must be manually set to Side lights "ON."
- When the ignition switch is at position "0," the exterior/instrument panel lights are switched off.

The switching thresholds of the rain/light sensor can be set to 2 different levels using the Car Memory function.

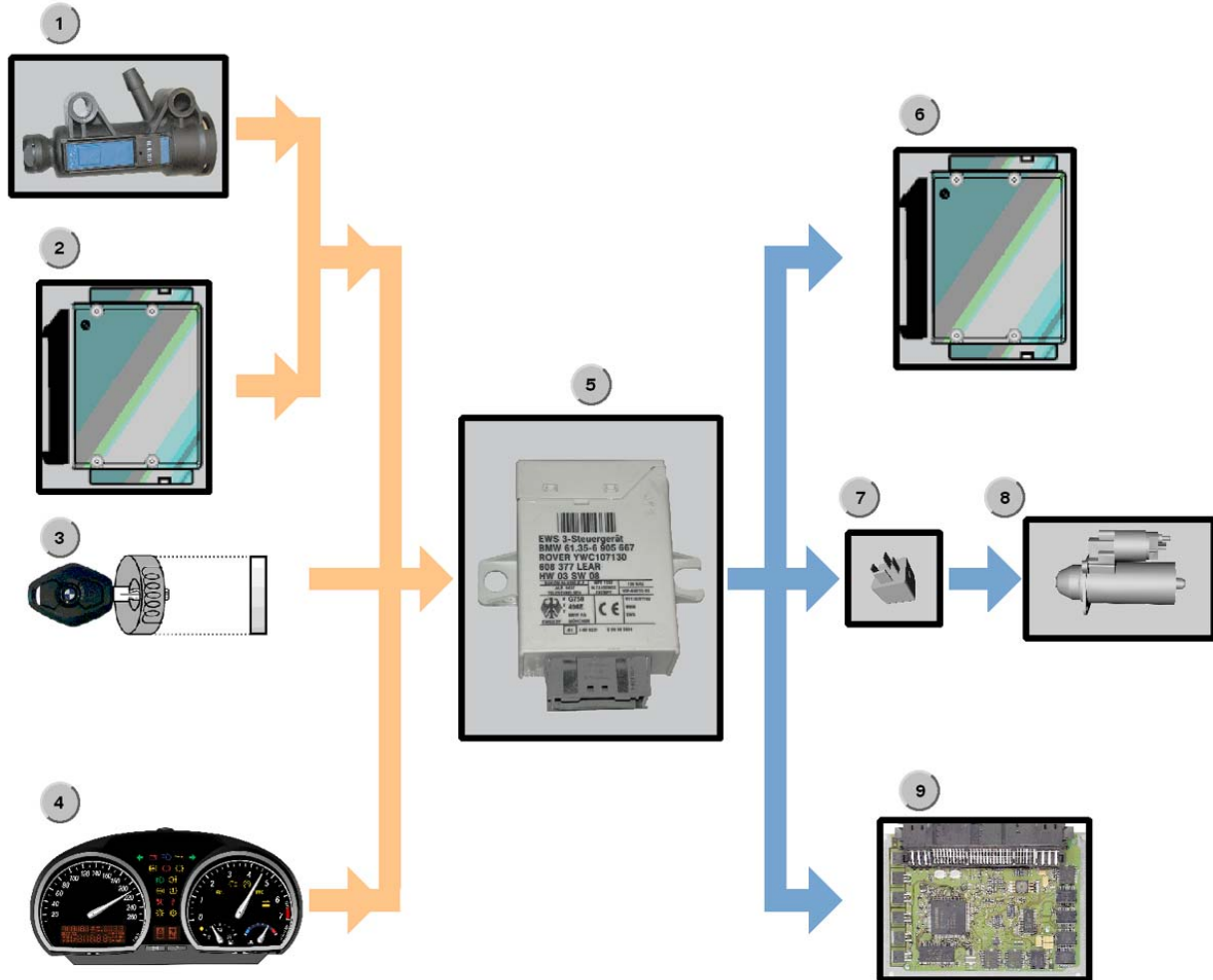
Safety Notice!!!

Automatic control of the headlights is not a substitute for individual assessment of the light/visibility conditions (e.g. fog) by the driver. In order to avoid safety risks in such situations, the lights must be switched on manually by the driver. The rain sensor controls the windshield wiper interval in rain or snow.

Note: If the wiper switch is set to intermittent wipe, the activation condition is detected above a certain wiper frequency. When the vehicle leaves the factory, that wiper frequency is set to 15 wiper cycles per minute. The sensitivity of the rain sensor can be set to four different levels using the knurled adjuster on the wiper switch.

Electronic Vehicle Immobilizer

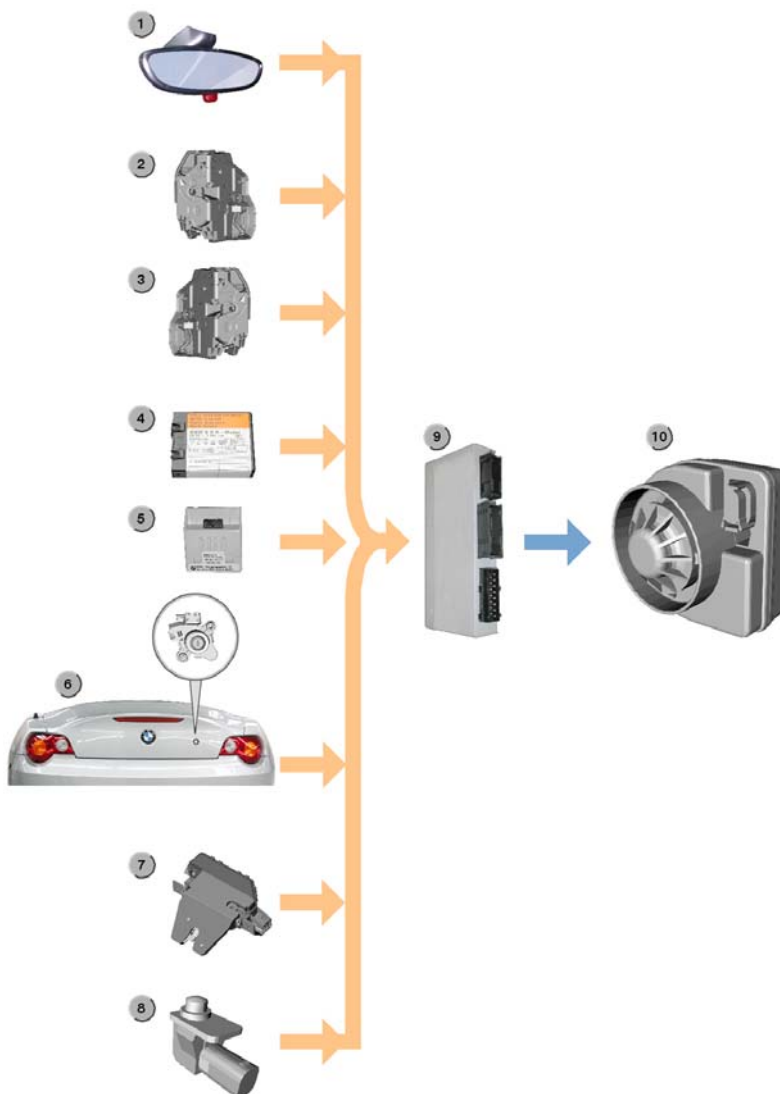
The familiar version 3.3 electronic immobilizer is fitted on the E85.



Index	Explanation	Index	Explanation
1	Clutch Switch Module	6	DME (ECM)
2	DME (ECM)	7	Starter Motor Relay
3	Ignition Lock	8	Starter Motor
4	Instrument Cluster	9	Transmission Control Module (EGS or SMG)
5	EWS Module		

Anti-theft Alarm System

The anti-theft alarm system on the E85 is based on the system used on the E46.



Index	Explanation	Index	Explanation
1	Anti-theft Alarm System LED	6	Trunk lock switch
2	Driver's door switch	7	Trunk lock assembly
3	Passenger door switch	8	Trunk position switch
4	SDR (Not used on USA)	9	General Module (GM V)
5	Tilt Sensor	10	Siren

New System Features

Disabling Tilt Sensor

The tilt sensor are temporarily disabled under certain circumstances.

Emergency Trunk Release

If the trunk emergency release is operated from inside, the alarm is set off if the anti-theft alarm system is armed.

System Functions

Disabling Tilt Sensor

The the tilt sensor are temporarily disabled under the following circumstances:

- For the first 30 seconds after the anti-theft alarm system is armed
- Once the anti/theft alarm system has been armed, while either of the doors or the trunk is open (30-second inhibition period does not start until they are all closed)

Emergency Trunk Release

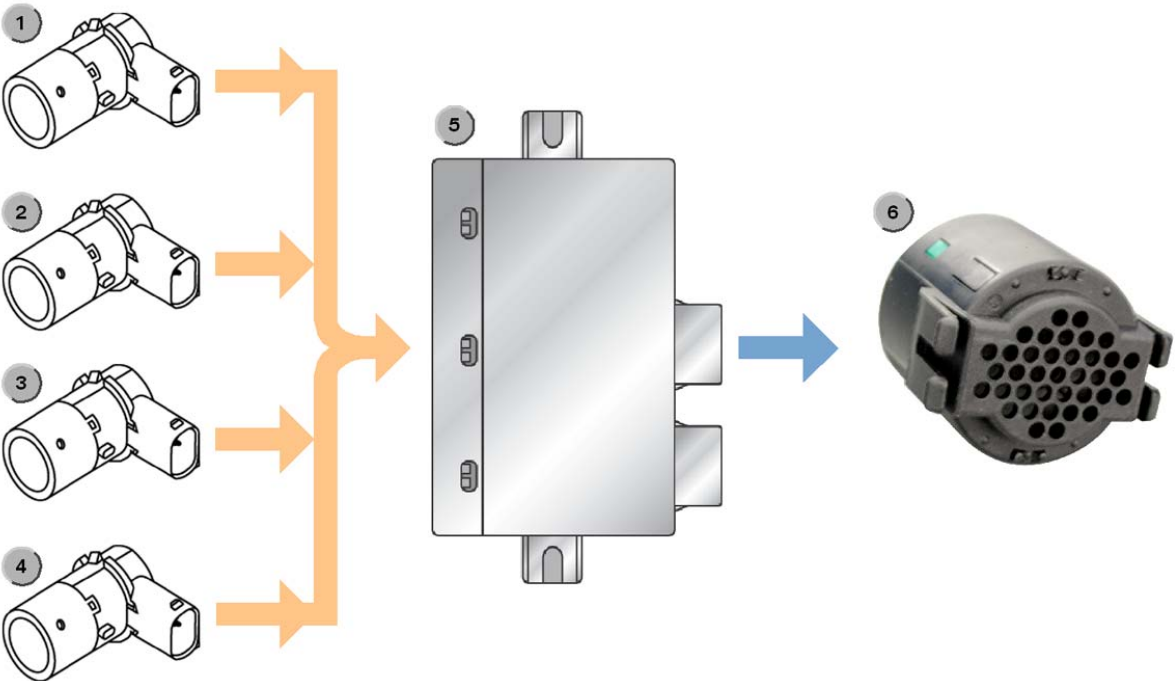
The trunk can be released from inside the trunk in an emergency. Operation of the trunk emergency release sets off the alarm if the anti-theft alarm system is armed.

Park Distance Control

Introduction

The Park Distance Control system is familiar. On the E85, it is a 4-channel system which only monitors the rear of the vehicle.

System Overview



Index	Explanation	Index	Explanation
1	Ultrasonic Transducer	4	Ultrasonic Transducer
2	Ultrasonic Transducer	5	PDC Control Unit
3	Ultrasonic Transducer	6	Gong

Consumer Cut-off

Introduction

This chapter describes the alterations to the central body electrical system (ZKE), "electrical consumer unit shutdown" (VA) and "sleep mode" as compared to the E46 electrical system.

Changes Compared to E46

Consumer Unit Shut-down

There are 2 outputs for consumer unit shut-down.

Sleep Mode

New conditions

K-Bus Messages

New messages

System Functions

Consumer Shut-down

The outputs VA1 and VA2 are available for consumer unit shut-down. The general module 5 has been expanded. There is now a second output available for consumer unit shut-down (VA). The consumer unit shut-down function switches consumer units to Sleep mode after 16 minutes.

Consumer Unit Shut-down 1 (VA1)

Consumer unit shut-down output 1 is factory-configured as a pulse-width modulated output. The consumer units connected to consumer unit shut-down output 1 are the following:

- Storage compartment light
- Trunk light
- Reading lights

In the event of an overload or short circuit, consumer unit shut-down output 1 is switched off by the general module 5 unless there is no load connected to the output (open load).

Once switched off, the output is switched on again by terminal R "OFF/ ON" provided the fault (overload or short circuit) is no longer present.

Consumer Unit Shut-down 2 (VA2)

Consumer unit shut-down output 2 is available as a permanent general module 5 output.

Consumer unit shut-down output 2 is overload and short-circuit proof. The consumer units connected to consumer unit shut-down output 2 are the following:

- Illuminated shifting gate on center console (USA version)
- Sequential Manual Transmission control unit

The permanent consumer unit shut-down output 2 is intended for electronic control units. The electrical control units require a permanent output as otherwise they would not be able to function.

Sleep Mode

The preconditions for Sleep mode are the following:

- Window regulators deactivated for 1 second
- Consumer unit shut-down and interior lighting passive
- Diagnostic mode not active
- K-Bus in Sleep mode
- On "Go to Sleep Mode" signal after 1 second or within 30 seconds of the anti-theft alarm system being armed

K-Bus Messages

The K-Bus now contains messages that may be addressed to all or multiple control units.

Diagnosis

Consumer Unit Shut-down

The diagnostic capabilities of the general module 5 have been extended. The general module 5 can distinguish between the following load conditions at the consumer unit shut-down outputs:

- Overload
- Short circuit
- No load connected (open load)

The various faults can be diagnosed.

Consumer unit shut-down output 2 (VA2) is overload and short-circuit proof. An overload is detected by the general module 5.

Door Mirrors

Introduction

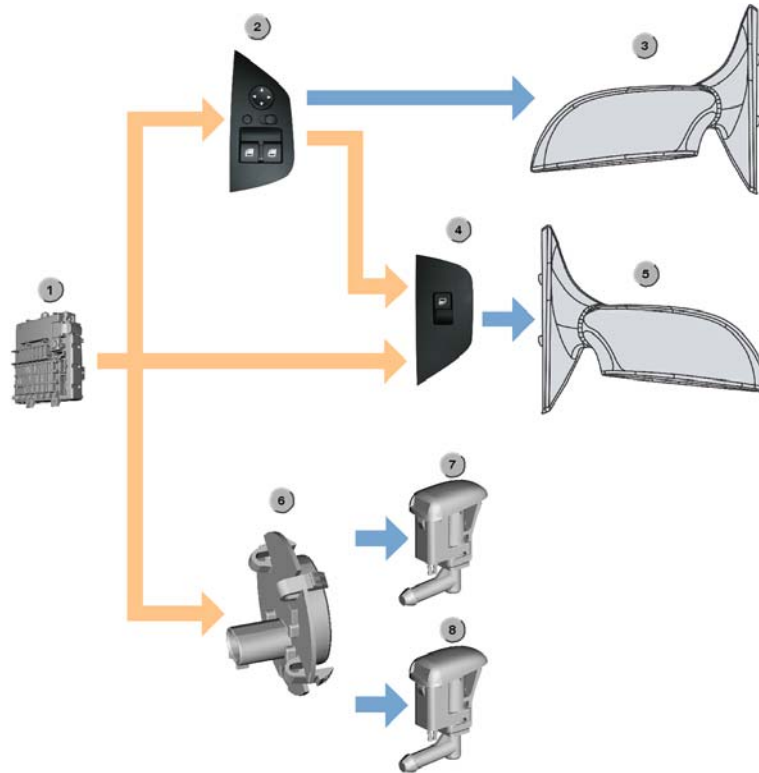
The functions of the door mirrors on the E85 are largely the same as on the E46.

Options offered on the E85 are electrochromatic mirrors, the mirror folding function and the winter package.

New System Features

The temperature switch for the heated washer jets is at the front on the left under the cover on the vehicle underbody.

System Overview



Index	Explanation	Index	Explanation
1	Fuse Box	5	Passenger Door Mirror
2	Driver's Switch Unit	6	Temperature Switch
3	Driver's Door Mirror	7	Left Heated Washer Jet
4	Passenger Switch Unit	8	Right Heated Washer Jet

Components

The system consists of the following components:

- Door mirrors on driver's side and passenger side
- Mirror adjuster button, driver's side
- Rear-view mirror (if electrochromatic option fitted)
- Mirror folding module (Located at the base of the A pillar)
- Mirror heater
- Temperature switch
- Heated washer jets
- Temperature switch (switches on the heaters for the heated washer jets)

Lights

Headlights

The E85 headlights are fitted with halogen bulbs as standard for both the low and high beams.

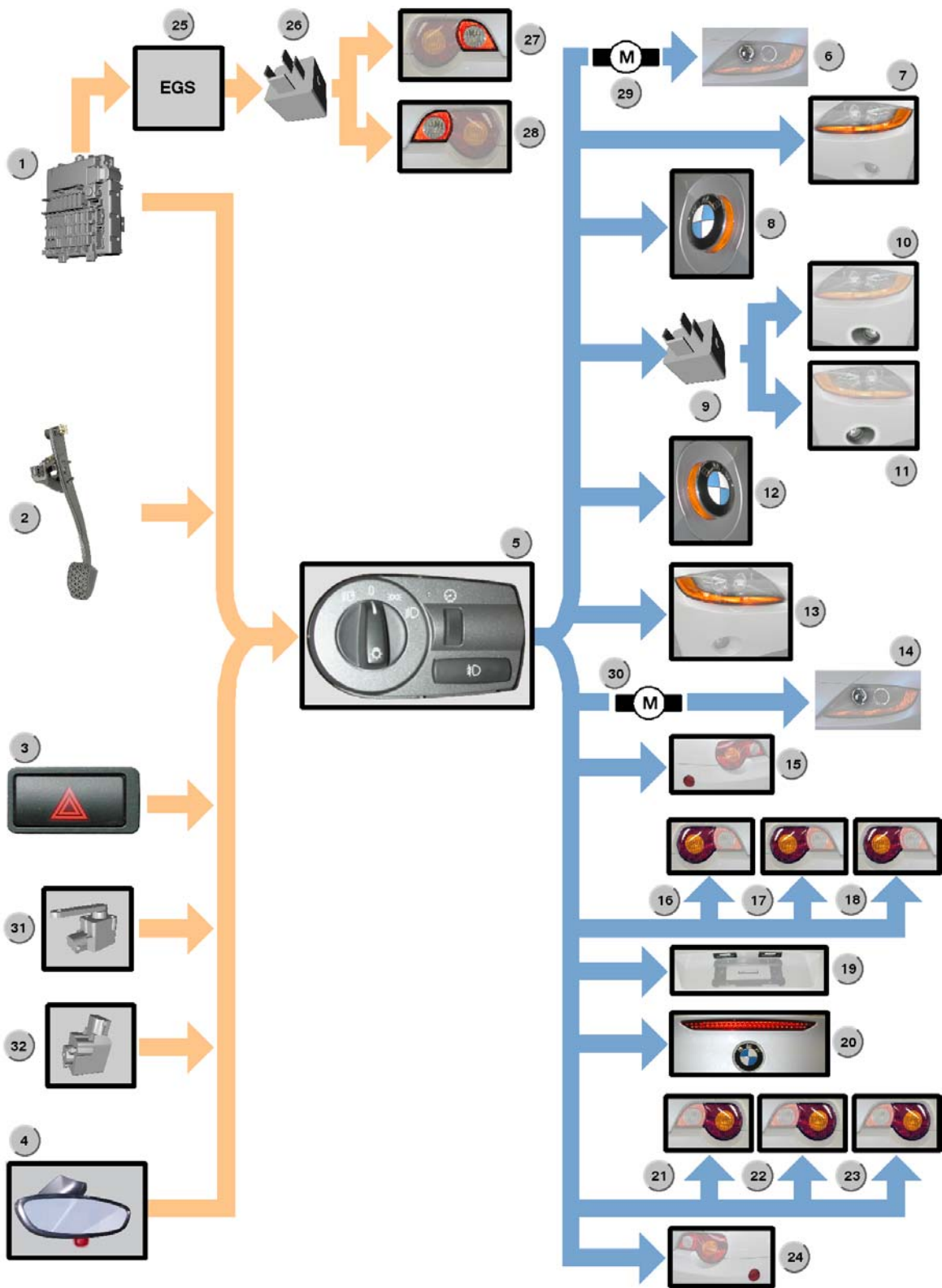
Bi-xenon bulbs are available as an option. If the bi-xenon option is fitted, a dynamic beam-height adjustment system is also fitted. Lighting configurations for the E 85 are as follows:

- US version with halogen headlights without manual beam height adjustment
- US version with dynamic beam-height adjustment and bi-xenon headlights

The US versions also have two sidemarker LEDs. They are integrated in the left and right side sections of the rear bumper.



Lighting System Overview



Legend for System Overview

Index	Explanation	Index	Explanation
1	Fuse Box	17	Rear Brake light (Compartment 2)
2	Brake Light Switch	18	Rear Turn Signal
3	Hazard Warning Switch	19	License Plate Lights
4	RLS	20	3rd Brake Light
5	LSZ	21	Rear Brake light (Compartment 1)
6	Bi-xenon Headlights	22	Rear Brake light (Compartment 2)
7	Front Turn Signal	23	Rear Turn Signal
8	Side Repeater	24	Rear Side Marker
9	Fog light Relay	25	Transmission Control Module (EGS/SMG)
10	Fog Light	26	Back-up Light Relay
11	Fog Light	27	Back-up Light
12	Side Repeater	28	Back-up Light
13	Front Turn Signal	29	Bi-xenon adjusting motor
14	Bi-xenon Headlight	30	Bi-xenon adjusting motor
15	Rear Side Marker	31	Height sensor, front
16	Rear Brake light (Compartment 1)	32	Height sensor, front

Front Light Clusters



Index	Explanation	Index	Explanation
1	Turn Signal Indicators	3	Low Beam Lights
2	Fog Lamps	4	High Beam Lights

Rear Light Clusters



Index	Explanation	Index	Explanation
1	Rear Brake Lights	4	Back-up Lights
2	Turn Signal Lights	5	3rd Brake Lights
3	Brake Force Display Lights	6	License Plate Lights

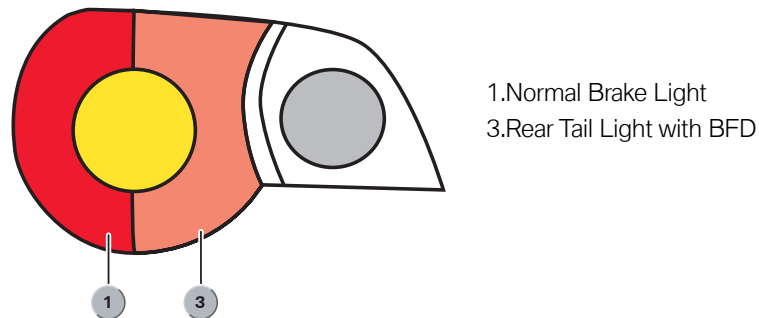
Rear/Brake Light

The rear-light and brake-light bulbs are in separate compartments in the left and right light clusters. When the headlights are switched on, all bulbs in compartments 1 and 3 are switched on. Those bulbs have a power rating of 21 Watts. For the rear light function, all four bulbs are controlled by pulse-width modulation. This dims all four bulbs to 5 Watts.

During braking, the light switch center receives a signal from the brake light switch. The light switch center then applies 21 Watts to the bulbs in compartment 1. In that way, the brake light function is performed.

Brake Force Display

In order to improve the reaction of other drivers to an emergency stop, the E85 has a Brake Force Display system. Its purpose is to reduce the likelihood of being driven into by the vehicle behind.



The Brake Force Display function will only be available on the US version at series launch.

If a deceleration of more than 5m/s^2 or an ABS signal is detected, the bulbs in compartment 3 are activated by the light switch center. They too then receive the full 21 Watts of power. In this way, the brake light plus Brake Force Display function is performed.

Sidemarkers Lights

The US version has two sidemarkers lights in the rear plastic bumper panel. They are LED light units.

Bi-xenon Headlights

The optional bi-xenon headlights represent a major advance in road illumination and headlamp range. Their function is identical to the bi-xenon headlights on the E46.

When the headlights are switched on using the steering column stalk, an electromagnet controls a movable beam-pattern screen in the ellipsoid module of the dipped-beam headlight. That screen then uncovers the high part of the headlight beam.

Note: If the headlight flasher function is required, the bi-xenon beam-pattern screen is not activated. Only the high-beam headlight (H7) is activated. The bi-xenon light reacts too slowly to that signal.

Light Switch Center

The light switch center controls the entire exterior lighting system. The following components are integrated in the light switch center, depending on equipment level.

- Light switch
- Switch for fog lamps
- Dimmer control for dashboard, instrument cluster and locator lighting (terminal 58)
- Photocell for detecting ambient light conditions

The light switch center has the capability of adjusting the effective voltage at all outputs by means of pulse width modulation. With the exception of those for the bi-xenon headlights all output voltages are pulse width modulated.

Control of the effective voltage levels by pulse width modulation allows brightness fluctuations due to variations in the load on the vehicle's electrical system to be evened out. The electrical system voltage has to be higher than the desired effective voltage.

Rain/Light Sensor

The Rain/Light sensor (RLS) is an addition to the lighting system used to switch the headlights on or off automatically based on ambient light conditions. Refer to the wiper system section in this training module for more information.

Interior Lights

Changes Compared to E46

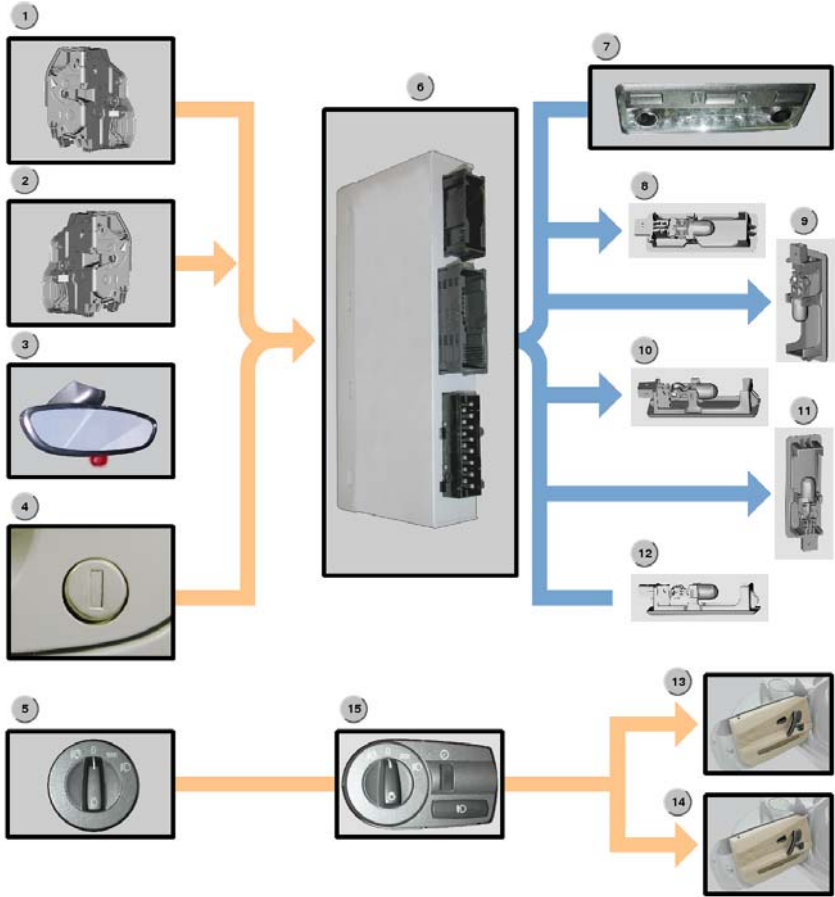
The interior lighting is controlled by the general module V. In order to even out the light power fluctuations that are made more likely by the use of the NG engines (in future - probability of high power draw by Valvetronic electric motors), the voltage for the vehicle lights is provided by means of a pulse-width modulated signal with a fixed frequency of 100 Hz. By varying the pulse width, and thereby the voltage, applied to the light bulbs, the fluctuations referred to above can be compensated for.

The general module V has a fault feedback function. If the power driver in the general module V detects the failure of a bulb, the output on the general module V is shut down. That means that no power is available at that output any longer. If the defective bulb is replaced and terminal R switched OFF/ON, power is available at the general module output again.

The interior door handle lights and center console lights as well as the ambience lights in the interior light unit are controlled by the light switch center.

The storage compartment also has a light. That light has a microswitch and two bulbs.

Interior Lighting System Overview



Index	Explanation	Index	Explanation
1	Driver's Door Contact	9	Driver Footwell Light
2	Passenger Door Contact	10	Luggage Compartment Light
3	Remote Receiver	11	Storage Box Lighting 1
4	Driver's Door Lock	12	Storage Box Lighting 2
5	LSZ	13	Driver Inside Handle Lighting
6	General Module (GM V)	14	Passenger Inside Handle Lighting
7	Interior and Reading Lamp Module	15	LSZ
8	Passenger Footwell Light		

Fully Automatic Soft-Top

CVM4 Introduction

The E85 will be available with a manual or an electro-hydraulic soft-top. On vehicles with the electro-hydraulic soft-top, the Soft-top module IV will be fitted. There will also be a hardtop for the E85.

The system has the following predecessor systems:

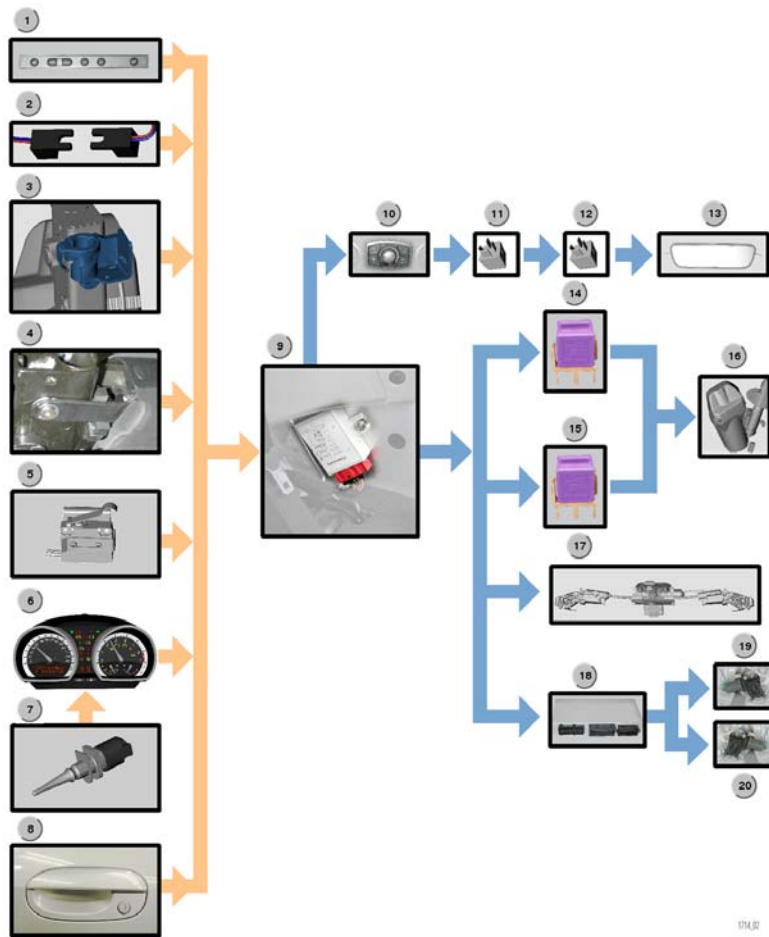
Predecessor Systems	Series	Model	Dates
Soft-top Module 1	E36	Convertible	1995 - 3/2000
Soft-top Module 2	E46iC	Convertible	3/2000 to present
Soft-top Module 3	E52	Z8	3/2000 to present

Fully Automatic Soft-top Components

The system consists of the following components:

- Fully automatic soft-top
- Soft-top module 4 (CVM4)
- Hall-effect sensors (2) for Soft-top position
- Hall-effect sensors (2) for Windshield Rail lock position
- Locking servo unit, front
- Hydraulic pump
- Hydraulic pump relays (2)
- Left (hardtop detection) and right hardtop locating socket contacts
- Microswitch for variable-size soft-top stowage compartment
- General module 5
- Instrument cluster
- Heater control panel
- Relay 1 for rear window heater
- Relay 2 for rear window heater
- Rear window heater
- Soft-top control button with LED (for soft-top DOWN)
- Soft-top control button with LED (for soft-top UP)

CVM System Overview



Index	Explanation	Index	Explanation
1	Soft-top Control Panel	11	Relay 1 for Heated Rear Window
2	Windshield Rail Hall-Effect Sensors	12	Relay 2 for Heated Rear Window
3	Hardtop Detectors	13	Rear Window Heater
4	Soft-top Position Detectors	14	Down Relay for Soft-Top Pump
5	Storage Compartment Microswitch	15	Up Relay for Soft-Top Pump
6	Instrument Cluster	16	Hydraulic Pump
7	Temperature Sensor	17	Windshield Rail Lock
8	Driver's Door Lock	18	GM V
9	CVM 4	19	Driver's Window Regulator
10	Heater Control Panel	20	Passenger Window Regulator

Principle of Operation

The Soft-top module IV controls the raising and lowering of the electro-hydraulic soft-top in response to the commands from the soft-top control buttons.

Preconditions for raising/lowering that are detected directly by the Soft-top module IV:

- Hall-effect sensor 1 for the windshield top-rail lock signals that the windshield top-rail lock is disengaged (soft-top unlocked)
- Hall-effect sensor 2 for the windshield top-rail lock signals that the windshield top-rail lock is engaged (soft-top locked),
- The Hall-effect sensor (for soft-top raised) on the hinge of the main pillar signals that the soft-top is raised, or
- The Hall-effect sensor (for soft-top lowered) on the hinge of the main pillar signals that the soft-top is stowed in the stowage compartment
- The hardtop detector signals that no hardtop is fitted
- The microswitch of the variable-size stowage compartment indicates that the stowage compartment base is at its lowest position
- The Soft-top module IV has not detected any faults on the system as a whole during its internal system test

Other conditions that are detected indirectly by the Soft-top module IV:

- Ignition key at position R at least
- Window not closed
- Vehicle stationary (road speed < 4 km/h)
- No short circuit and no circuit break present
- Outside temperature is not below the limit of approximately. -20°C
- Soft-top button pressed

The Soft-top module IV exchanges information via the K-Bus. The Soft-top module IV monitors the Hall-effect sensors for plausibility of the signals and correct function. There are 2 Hall-effect sensors fitted to the hinge of the main pillar. There are 2 Hall-effect sensors on the front roof bow of the electrohydraulic soft-top.

Response to High/Low Voltage

The voltage range of the Soft-top module IV is 9 V to 16 V.

Method of operation of soft-top stowage compartment lock

The soft-top stowage compartment lock holds the soft-top in place when it is fully stowed in the compartment. When the soft-top is raised, it locks onto the windshield top rail.

Operation of soft-top stowage compartment lock when lowering soft-top

When the electro-hydraulic soft-top is fully lowered into the stowage compartment it is automatically locked in position. This is effected by the electro-hydraulic soft-top being lowered to a position in the stowage compartment where the mechanical locking mechanism engages.

The Hall-effect sensor on the hinge of the left-hand main pillar signals to the Soft-top module IV that the electrohydraulic soft-top is in the fully lowered (stowed) position. The locking latches on the electro-hydraulic soft-top are then also engaged. The locking latches are controlled by the Soft-top module IV.

When the electro-hydraulic soft-top is in the fully lowered (stowed) position, the Soft-top module IV switches the hydraulic pump off. The relay is switched off by virtue of the fact that it is no longer enabled by the Soft-top module IV.

The electro-hydraulic soft-top is now fully lowered into the stowage compartment.

Operation of soft-top stowage compartment lock when raising soft-top

When the electro-hydraulic soft-top is raised, the stowage compartment catch is released, the locking latches disengaged and the soft-top raised out of the stowage compartment. On the windshield top-rail, the locking latches engage and lock the electro-hydraulic soft-top in position.

Operation of soft-top stowage compartment lock

The soft-top stowage compartment lock mechanism engages the latches of the fully automatic soft-top when it is fully lowered into the stowage compartment. When the fully automatic soft-top is raised, the latches are engaged in the windshield top rail.

The fully automatic soft-top is now fully lowered into the stowage compartment.

Operation of soft-top control buttons

The soft-top control buttons for controlling the soft-top UP and DOWN actions are switches that connect to ground. Closing the connection to ground signals to the Soft-top module 4 that raising or lowering of the fully automatic soft-top has been requested.

Operation of Hall-effect Sensors

The Hall-effect sensors signal the position (LOCKED or UNLOCKED) of the locking latches to the Soft-top module 4.

Operation of Soft-top Relays

The Soft-top module 4 controls the relays. The 2 relays for the hydraulic pump are controlled as required (for raising or lowering soft-top) by the Soft-top module 4.

The relays are wired in such a way that the hydraulic pump action is reversible. The relays are controlled by the Soft-top module 4 via High side switches. On a High-side switch, the transistor connects positive through.

Soft-top latch for locking to windshield top rail

The locking latches are closed when they locate in the windshield top rail. The left and right locking latches are closed when they locate in the windshield top rail. The rotation of the DC motor is transmitted to spindles. The spindles drive linkages. The action of the linkages is transmitted to the locking latches. The locking latches lock/unlock the fully automatic soft-top to/from the windshield top rail.

The position of the locking latches is detected by Hall-effect sensors 1 and 2

Microswitch for variable-size soft-top stowage compartment

The microswitch signals to the Soft-top module 4 that the stowage compartment base is at its lowest position. The Soft-top module 4 is informed by the microswitch that the movable stowage compartment base is at its lowest position. The microswitch is a make-switch that connects to earth.

GM5

The general module 5 opens or closes the windows on instruction from the Soft-top module 4. The general module 5 stores the current status of trunk and window position. The general module 5 places the following information on the K-Bus when it starts up:

- Current status of trunk and windows
- Changes to current status of trunk and windows

Examples of current status information are:

- Window closed; window open,
- Trunk closed; trunk open.

(The signal for the trunk status is present but is not required by the Soft-top module 4)

The general module 5 receives the control commands for raising and lowering the windows from the Soft-top module 4. The Soft-top module 4 sends the control commands via the body electronics bus before and after raising/lowering the soft-top. The precondition for lowering the windows is that at least one window is closed.

If the windows are already open before the soft-top is raised/lowered, and if one of the two soft-top control buttons remains pressed (2 s) after the soft-top has been fully raised/lowered, the windows are closed. Closing of the windows is stopped as soon as either of the soft-top control buttons is released or the window mechanism detects that the window is closed (at limit of movement).

Soft-top stowage compartment lock

The locking latches are closed when the soft-top is stowed in the stowage compartment and the soft-top locked in position. As soon as the fully automatic soft-top is stowed in the stowage compartment, the locking latches close.

Notes for Service

Soft-top module IV time-out function

If the soft-top control button remains pressed after the soft-top has stopped moving, the Soft-top module IV detects a fault. The fault is interpreted as "Short to ground on soft-top button or one of the leads" and the fault is recorded in the Soft-top module fault memory.

However, the electro-hydraulic soft-top can still be moved to a safe parked position using the other soft-top control button/ lead, which is still functioning. If the button is released while the soft-top is still in motion, the soft-top is stopped (safety function).

Once the fault has been rectified and terminal R switch off and on again, the electro-hydraulic soft-top can be controlled by the soft-top button again.

Diagnosis

The diagnostic functions of the Soft-top module IV are to a large degree identical with those on the E46. However, fewer signals are analyzed on the E85 than on the E46 because there are fewer components on the E85.

Soft-top module 4 internal check

The internal functions of the Soft-top module 4 are checked under the following circumstances:

- When the power is switched on
- When terminal R is ON
- Before the soft-top is raised/lowered

If a system fault is detected, movement of the soft-top is stopped immediately. The fault detected is recorded in the fault memory of the Soft-top module 4. If the nature of the fault allows, the soft-top can be moved to the nearest safe parked position using one of the soft-top control buttons.

Control button for raising soft-top

A short circuit on the control button for raising the soft-top would raise the soft-top. The soft-top can still be moved to a safe parked position using the functioning control button for lowering the soft-top.

Control button for lowering soft-top

A short circuit on the control button for lowering the soft-top would lower the soft-top. To prevent the soft-top lowering, the functioning control button for raising the soft-top can be used to move the soft-top to a safe parked position.

Electric Locking System

The electric locking system is fitted with an overload protection circuit. The overload protection circuit has a time-out function as well as the hardware systems. In the event of misuse, e.g. while the soft-top is in motion, the time-out function disables the fully automatic soft-top function. After a certain time (when time-out has elapsed) the fully automatic soft-top function is restored.

Faults on Peripheral Systems

During the internal check and while the soft-top is being raised/lowered, the signals from peripheral systems are checked for plausibility. Those signals must be within the defined valid operating ranges.

Examples of peripheral system signals are:

- Outside temperature
- Vehicle stationary signal
- Signals from the fully automatic soft-top, etc.

Storage of Faults

Faults are stored in the order in which they occur. The Soft-top module 4 has up to 16 "fault storage locations" available in its fault memory. Each fault storage location has a frequency counter which counts up to 31.

Status signals from soft-top module 4

The Soft-top module 4 supplies the general module 5 and all other bus nodes with the current status signals. The Soft-top module 4 provides the following status signals:

- Reset
- Status request
- Ready after reset

General module 5 window regulator safety function

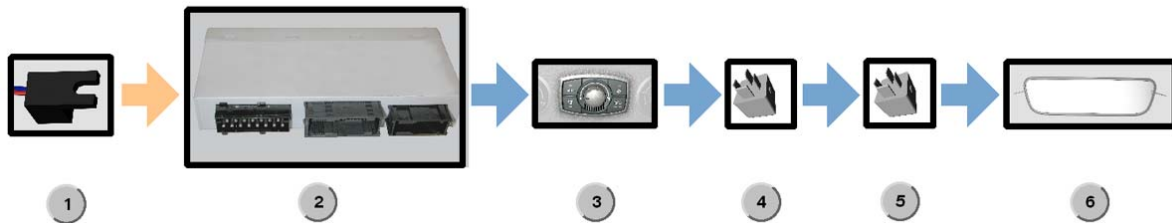
The general module 5 stops the windows being closed immediately with the loss of the Close windows signal.

Manual Soft-top

The system consists of the following components:

- Manual soft-top
- General module 5
- Heater control
- Left and right hardtop locating socket contacts
- Relay 1 for rear window heater
- Relay 2 for rear window heater
- Rear window heater
- Hall-effect sensor for detecting when soft-top is raised and locked to the windshield top rail (enable signal for relay 2)
- Button lock for manual soft-top

Manual Soft-Top System Functions



Index	Explanation	Index	Explanation
1	Hall effect sensor for relay to enable rear window heater.	4	Relay 1 for Heated Rear Window
2	General Module (GM V)	5	Relay 2 for Heated Rear Window
3	Heater Control unit	6	Rear Window Heater.

Rear Window Heater

The rear window heater cannot be switched on until the relay is enabled according to the enabling conditions.

As with the hardtop, the rear window heater is switched on by the rear window heater button. Relays 1 and 2 for the rear window heater pick up, thereby connecting the rear window heater to terminal 30. Relay 2 must have been enabled.

Relay enabling - Relay 2 is enabled by the Basic module 5 which sends a message via the K-Bus to the heater control panel.

The general module 5 does not send that message unless the following preconditions are satisfied:

- The Hall-effect sensor on the manual soft-top signals that the soft-top is raised and locked to the windshield top rail.

Hardtop Detection

Hardtop detection prevents the soft-top being raised when the hardtop is fitted.

When a hardtop is fitted, the right-hand hardtop locating socket contact is used to detect the presence of the hardtop. The hardtop's rear window heater is supplied with power via the left-hand hardtop locating socket contacts (right and left).

Button Lock for Manual Soft-Top

The button lock is integrated in the central locking system.

When stowed in the stowage compartment, the soft-top is locked in place by a catch. That catch has to be released in order to raise the manual soft-top. The button at the top of the bulkhead trim is for releasing the catch.

Hardtop

Hardtop Components

The system consists of the following components:

- Hardtop
- Heater control
- Left and right hardtop locating socket contacts
- Relay 1 for rear window heater
- Rear window heater

Hardtop System Functions

Rear Window Heater

The rear window heater is switched on by the rear window heater button. The button is fitted in the heater control panel (center console). The button is a make-switch that connects to earth; the LED lights up when the switch is on.

Relay 1 for the rear window heater picks up, thereby connecting the right-hand hardtop locating socket contacts to terminal 30. When the hardtop is fitted, the left-hand hardtop locating socket contact is the input (terminal 30) of the rear window heater. The right hand hardtop locating socket contact is connected to earth.

Note: (Rear Window Heater Button) - When the button is pressed in, the LED is always on, regardless of whether the rear window heater can actually be operated or not.



Workshop Exercise

Using an instructor designated vehicle, perform a complete vehicle short test. Proceed with diagnosis based on the complaint supplied by instructor. Complete worksheet using the proper format regarding complaint, cause and correction.

Vehicle: _____ Chassis #: _____ Production Date: _____

Complaint: _____

Cause: _____

Correction: _____



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Complaint: _____

Cause: _____

Correction:



Classroom Exercise - Review Questions

1. Why is One-Touch closing not allowed on the passenger side window?

2. How does the GM V determine if a lock or unlock signal is received from the driver's door latch assembly?

3. How many Hall-Effect Sensors are used to determine Soft-Top Positions ?
And what are their locations?

4. What are the preconditions for raising and lowering of the Soft-Top
(Fully Auto top)?

5. When are the internal functions of the CVM 4 checked?



Classroom Exercise - Review Questions

6. What changes have been made to the K-Bus messaging?

7. Under what conditions is the Brake Force Display active?

8. Where is the GM V located?

9. How is the Heated Rear Window controlled?

10. Why is the voltage supplied to the interior lights a PWM signal?
